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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/724,111	12/01/2003	Yoshio Okayama	65933-056	9924
7590 07/29/2004				
McDERMOTT, WILL & EMERY 600 13th Street, N.W. Washington, DC 20005-3096		EXAMINER GURLEY, LYNNE ANN		
		ART UNIT 2812 PAPER NUMBER		

DATE MAILED: 07/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/724,111

Applicant(s)

OKAYAMA ET AL.

Examiner

Lynne A. Gurley

Art Unit

2812

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 01 December 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.


## Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 December 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

  
LYNNE A. GURLEY  
PRIMARY PATENT EXAMINER  
TC 2800, AU 2812

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 12/1/03.

- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Priority***

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

### ***Information Disclosure Statement***

2. The information disclosure statement (IDS) submitted on 12/1/03 has been considered by the examiner.

### ***Drawings***

3. The drawings are objected to because figures 1A-1D and 2A-2D should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance. Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be

Art Unit: 2812

renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### *Specification*

4. The disclosure is objected to because of the following informalities: On page, 9, lines 5-8, "insulating film" should be "an insulating film". Also, please note that the specification has a few grammatical errors (i.e. punctuation such as commas are needed to break up some of the lengthy sentences . See page 5, lines 5-10.

Appropriate correction is required.

5. The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

### *Claim Objections*

6. Claims 5-6, 11-12, 17-18 are objected to because of the following informalities: In claim 5, line 21, "remove said" should be "removes said". Appropriate correction is required.

*Claim Rejections - 35 USC § 102*

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claim 1 is rejected under 35 U.S.C. 102(b) as being clearly anticipated by Shinichi (JP 2002-208633, dated 7/26//02).

Shinichi shows the method as claimed in figures 1-3, abstract, and corresponding text, as forming an insulating film 3 on a semiconductor substrate 1, forming a concave 7 in the insulating film and then forming a metal film 8 filling the concave; conducting a first polishing (figs. a-d, in abstract) over a whole surface of the substrate to form metal area filled in the concave; and conducting a second polishing over the whole surface of the substrate to remove parts of the metal area and of the insulating film (figs. d-e, in abstract).

9. Claims 1 and 3 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Lukane et al. (US 6,117,782, dated 9/12/00).

Lukane shows the method as claimed in figures 4-6, and corresponding text, as forming an insulating film 3/4 on a semiconductor substrate 1, forming a concave (fig. 4) in the insulating film and then forming a metal film 5 filling the concave; conducting a first polishing (fig. 5) over a whole surface of the substrate to form metal area filled in the concave; and conducting a second polishing over the whole surface of the substrate to remove parts of the metal area and of the insulating film (fig. 6). A sacrificial film 4 is formed on the insulating film 3. It is inherent that the polishing step would have to incorporate at least two steps (including at least two

Art Unit: 2812

polishing slurries) to remove the metal, the adhesion/barrier layers and then the insulating layer

4. Also, see Liu et al. (US 6,380,0780) for support in using two separate polishing steps.

### *Claim Rejections - 35 USC § 103*

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459

(1966), that are applied for establishing a background for determining obviousness under 35

U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

12. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Art Unit: 2812

13. Claims 1-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sameshima et al. (US 2003/0203624, filed 3/24/03) in view of Lukane et al. (US 6,117,782, dated 9/12/00).

Sameshima shows the method substantially as claimed in figures 1-13 and corresponding text, with emphasis on figure 7 and corresponding text for the dual damascene structure (a trench and a via), including a 2 step polishing method of a substrate with multi-layer interconnection, with a dual damascene interconnect 729/730 connecting to an underlying first interconnection 719. The dual damascene interconnect is filled with metal 732 and then a two step polishing process is conducted to planarize the structure (figs. 7D-7F; [0091]-[0100]). Sameshima also discusses end point detection based on thickness of the film per unit time and its effect on the polishing rate [0005].

Sameshima lacks anticipation only in not teaching that: 1) the insulating film has a normal taper formed in the upper part of the concave, which is in part removed in the second polishing step (claims 1-2, 7-8, and 13-14); 2) a sacrificial layer is formed on the insulating film and is selectively removed (claims 3-6, 9-12, and 15-18); 3) and forming the concave in the insulating film comprises etching the sacrificial film more slowly than the insulating film (claim 4).

Lukane teaches, in a damascene method, the planarization of a similar copper structure in an insulator which incorporates a sacrificial layer 3u, having a normal taper in the upper part of the concave. The incorporation of the sacrificial layer optimizes the trench/via profile for damascene filling.

It would have been obvious to one of ordinary skill in the art to have incorporated, in the method of Sameshima, as taught by the method of Lukane: an insulating film having a normal

Art Unit: 2812

taper formed in the upper part of the concave, which is in part removed in the second polishing step; a sacrificial layer formed on the insulating film, which is selectively removed and; etching the sacrificial film more slowly than the insulating film, when forming the concave in the insulating film, with the motivation that Lukane teaches, in such a similar method where reliable planarization is desired, that the sacrificial layer formed on the upper part of the insulating layer with a normal taper formed in its top surface leads to optimization of the trench/via profile for damascene filling (column 11, lines 51-67; column 12, lines 1-23 and 48-67, especially).

Additionally, with Lukane teaching different combinations of etching methods for the sacrificial and insulating layers, etching the sacrificial film at a slower rate than the insulating film would allow more control over the formation of the taper, resulting in a better subsequent metal fill (column 10, lines 48-67; column 11, lines 1-26).

### *Conclusion*

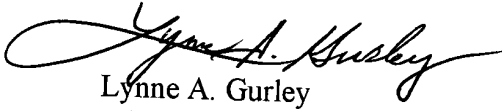
14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Please see the PTO Form 892 for additional prior art showing multiple CMP steps on damascene structures.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynne A. Gurley whose telephone number is 571-272-1670. The examiner can normally be reached on M-F 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling can be reached on 571-272-1679. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.



Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
Lynne A. Gurley  
Primary Patent Examiner  
TC 2800, Art Unit 2812

LAG  
July 23, 2004

